National
Qualifications

CS(H)16AMS

Computing Science
Marking Instructions

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General Marking Principles for Higher Computing Science

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this Paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key.

(a) Marks for each candidate response must always be assigned in line with these General Marking Principles and the Detailed Marking Instructions for this assessment.

(b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.

(c) Marks should be awarded regardless of spelling as long as the meaning is unambiguous.

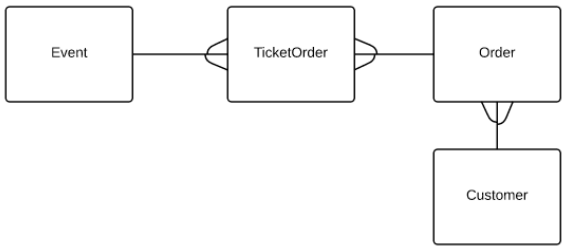
(d) Candidates may answer programming questions in any appropriate programming language or pseudocode. Marks should be awarded, regardless of minor syntax errors, as long as the intention of the coding is clear.

(e) Where a question asks the candidate to describe, the candidate must provide a statement or structure of characteristics and/or features. This should be more than an outline or a list. It may refer to, for instance, a concept, process, experiment, situation or facts in the context of, and appropriate to, the question. The candidates will normally be required to make the same number of factual/appropriate points as are awarded in the question.

(f) Where a question asks the candidate to explain, marks should only be awarded where the candidate goes beyond a description, for example by giving a reason, or relating cause to effect, or providing a relationship between two aspects. These will be related to the context of the question or a specific area within a question

Number			Question	Instructions	Marks
1			Convert the decimal number -126 to binary using 8 bits.	1000 0010- using 8 bit two's complement OR 1111 0110 – using signed bit method **1 mark**	**1**
2			Tables can be related by different types of relationships. State the types of relationship between the two tables in each case below.		
	a		Train journeys and People	Many to Many **(1 mark)**	**1**
	b		Drivers and Cars in a grand prix	One to One **(1 mark)**	**1**
3			Explain how cache memory can improve system performance.	• Frequently accessed data/ instructions are held in cache • Faster access memory (on the same chip as processor) • Reducing the need to access slower main memory **1 mark each bullet, max 2 marks** Note: Do not accept 'physically closer/ close to the processor'.	**2**
4			A program is used to display particular salesperson records. The algorithm for this program is shown below: (see paper) The following data is stored in the sales_person array: Karen, Paul, Jamie, Paul , Gillian, Rufus State the output from the above program if Paul is entered at line 2 from the keyboard.	**Paul 1** **1 mark for Paul** **1 mark for 1** **1 mark for correct location values if Paul is given twice** **Other 0 marks**	**2**
5			A database table may have a compound key. State what is meant by the term compound key.	A primary key with more than one field (or attribute or column) **(1 mark)**	**1**
6			Harry is writing a program on his PC that is intended to run on his smartphone. Explain why an emulator is required in the programming environment.	To run the object code/exe/machine code **(1 mark)** for a different processor than the one in the computer **(1 mark).**	**2**
7			Jamie regularly uses a shopping site called SuperHeroClothing. (See paper) Scripting is used to generate parts of the web site.		
	a		State one part of the website that is generated using client-side scripting.	Pull down menu (with autocomplete options) **(1 mark)**	**1**

Number			Question	Instructions	Marks
	b		State one part of the website that is generated using server-side scripting.	• "Your might also like" section • "Your Account/Your Preferences" links • User image • Initial search listing **1 mark for any one bullet**	**1**
8			A business intends to start using a data processing system to store data about individual customers. Describe **two** implications of the Data Protection Act (1998) for this business.	Answers must relate to the principals of the DPA: • used fairly and lawfully • used for limited, specifically stated purposes • used in a way that is adequate, relevant and not excessive • accurate • kept for no longer than is absolutely necessary • handled according to people's data protection rights • kept safe and secure • not transferred outside the European Economic Area without adequate protection **1 mark each bullet, max 2 marks**	**2**
9			One feature of an object-oriented language is the use of classes. A class definition is shown on lines one to six below. (see paper) State the feature being used in line 7 and explain a benefit of its use.	Creation of an object **(1 mark)** The class can be used to create multiple objects of the same type/properties **(1 mark)** Or Reduces the amount of code to create similar objects **(1 mark)**	**2**
10			Describe how usability testing could be carried out on a database system.	• End user group/independent test group • Given tasks to perform/observed performing tasks • To provide feedback/evaluate (ease of use/fit for purpose) **One mark each bullet, max 2 marks**	**2**
11			Describe two benefits of Agile software development methodologies.	• Ability to respond quickly to changes in requirements • Produces working releases of software early in development • End user significantly involved in development • Other valid **1 mark each bullet, max 2 marks**	**2**
12			A rock concert ticket agency uses the following relational database with four tables shown below. (see paper)		
	a		Identify a suitable primary key for the **TicketOrder** table.	Order No, Event ID **(1 mark)**	**1**

Number			Question	Instructions	Marks
	b		Draw an *entity-relationship diagram* to illustrate the relationships between the four tables.	 • Event to Ticket Order, Customer to Order, Order to Ticket Order, **All related and no others** • Two of above three are the correct 1:M • All three above are the correct 1:M **1 mark for each bullet, max 3 marks** **Many representations are possible.** **Accept 1:M, 1:N, 1:∞ and crow's feet.**	**3**
	c		A report is produced each time a customer places an order. An example is shown below. (see paper) This report is based on a query. State a list of the tables and fields that would be used in this query and any criteria that would be used to select the above data.	Customer.Customer Name Order.Date Order.Time Order.Order No (or TicketOrder.Order No) TicketOrder.Quantity Event.Event Name Event.Ticket Price Order No = 18728 • Award one mark for all four tables (Event, TicketOrder, Order, Customer) • Award one for six or seven correct fields • Award one mark for criteria of [order no] = 18728. *Cannot attain the mark awarded for bullet point two if two or more fields that should not be included are stated in an answer.* *Do not penalise for additional search criteria e.g. customer name.* *Allow tables and fields to be expressed separately.*	**3**
	d		The report includes a total of £404.96 after the 3 Line Costs. Describe how this can be done in the report.	SUM([TicketOrder.Quantity]*[Event.Ticket Price]) and is placed in the Report Footer • Use of SUM or clear description • Quantity*Ticket Price used or clear description • Report Footer or Summary field **1 mark for each bullet, max 3 marks** *Accept SQL answers that execute the calculation.*	**3**
13			The web page below has been created using Cascading Style Sheets (CSS). (see paper)		

Number			Question	Instructions	Marks
	a		Describe the purpose of Cascading Style Sheets.	CSS allow the designer to define the way a web page is formatted **1 mark**	**1**
	b		The code below is included in the HTML of a web page to link to an external style sheet: <link rel="stylesheet" type="text/css" href="styles.css"/>		
		i	Explain the difference between an external and an internal style sheet.	An Internal Stylesheet will be used to format one webpage only. **(1 mark)**. An external stylesheet will be used to format more than one webpage on your website. **(1 mark)**.	**2**
		ii	Explain one benefit of using an external style sheet.	One change to the external stylesheet will affect all webpages linked to it. **(1 mark)**	**1**
	c		Describe where in the HTML code the link to the external style sheet would be placed.	In the head section **(1 mark)**	**1**
	d		Describe the purpose of this line of HTML code used in this web page: 	is • the opening tag for the content div • a container in which all the content goes • used to define the various different sections of the web page **1 mark each bullet, max 2 marks**	**2**
	e		This webpage is categorised as a static webpage. Many users have said that it could be improved by having some dynamic content.		
		i	Describe an example of dynamic content that could be added to this webpage.	Any example of suitable dynamic content, for example: Today's weather **1 mark**	**1**
		ii	A dynamic website can contain client-side scripting or server-side scripting to generate the changing content. Describe one difference between client-side scripting and server-side scripting.	• Client-side scripting involves running scripts using a browser • Whereas the server-side scripting involves running scripts using a web server. OR • The processing of a Client-side script takes place on the end users computer • Whereas the web server is used to process a Server-side script and then return the HTML to the client browser. **1 mark each bullet in each part, max 2 marks**	**2**
14			Eilidh wants a program to process information about the friends in her address book. (see paper)		
	a		Explain the purpose of line 2.	Assigns values to (element zero of) an array **(1 mark)** of the address record **(1 mark)**	**2**

Number			Question	Instructions	Marks
	b		State the output from line 4.	Stuart(space)**(1 mark)** Mackenzie **(1 mark)**	**2**
	c		Eilidh wants to calculate the total number of calls made by the person at the beginning of her addressbook.	SET totalCalls TO (addressbook[0].missedCalls + addressbook[0].receivedCalls) **1 mark for correct use of addition operator and assignment syntax.** **1 mark for correct array index [0] and record fields.**	**2**
	d		Eilidh calculates the number of calls for each of the people in her address book. She stores these calculations in an array **in the same order** as her addressbook. She has decided to block anyone who has called her over 100 times and to count how many people this is. The code is shown below. (see paper) When Eilidh tests the program, it outputs the wrong number of blocked people.		
		i	State the output from the code above.	2 **(1 mark)**	**1**
		ii	State the name of this type of error.	Logic error **(1 mark)**	**1**
		iii	Identify and correct the line of the algorithm which contains the error.	Line 3 **(1 mark)** FOR addressPeople = 0 TO 5 DO **(1 mark)**	**2**
	e		Eilidh creates an algorithm that will search the array of callTotal and return the largest value present. (see paper) A trace table is used to record the change to a variable at the corresponding line number. Part of the trace table is shown below. State the values missing from the trace table below at A, B and C. (see paper)	A: 0 B: 1 C: 165 **1 marks each correct value, max 3 marks**	**3**
	f		Explain how breakpoints could be used in conjunction with a trace table to locate errors in code.	Stop/pause program at a defined point **(1 mark)** to check the values of the variables (match the expected value) **(1 mark)**	**2**
15			Jason is an App developer. He has recently created an App for mobile devices which allows users to identify the logos of well-known brands. The home screen of this App is shown below. (see paper)		

Number			Question	Instructions	Marks
	a		Describe the type of user Jason has designed this App for. Justify your answer.	Novice user **(1 mark)** • Simple, easy to use design • No previous experience of app is required to use **Any one bullet for 1 mark**	**2**
	b	i	Name the type of input device that would be best used with this app. Justify your answer.	Touch Screen **(1 mark)** • Don't need any extra hardware such as a keyboard or mouse • Touch screens work well with icon driven systems • Little data to enter so easily done with a touch screen **Any one bullet for 1 mark**	**2**
		ii	Describe a disadvantage of this type of input device.	• Users must be able to accurately select targets on touchscreens, and avoid accidental selection of adjacent targets. • Not suitable for entering large amounts of data • Not robust - can break easily if dropped • More expensive that alternatives such as mouse or keyboard **Any one bullet for 1 mark**	**1**
	c		The mobile device uses solid state storage to store the app.		
		i	State two reasons why solid state storage is used to store the app.	• Low power consumption • Small physical size • Physically robust • Fast access speeds • Other valid **1 mark each bullet, max 2 marks**	**2**
		ii	While developing the app, Jason used cloud storage to store the app file. Explain why Jason used cloud storage to store the app during development.	• accessible via the internet from any device • accessible via internet from any location • allows multiple uses to share, edit and save files/folders • Other valid. **1 mark for any bullet, max 2 marks**	**2**

Number			Question	Instructions	Marks
	d		This app is classified as "Open Source" software. Describe two benefits of open source software as opposed to proprietary software to the user.	• The source code (the medium in which programmers create and modify software) is freely available on the Internet / anyone can modify the software / Proprietary refers to software whose source code is usually a closely guarded secret and not available to users. • Open source software can be used without paying a license fee / Proprietary software requires the user to pay for a license fee. **1 mark for each bullet, max 2 marks**	**2**
16			The MacKay family have a wireless network to connect their computers, tablets, phones and printers together. Their devices are allocated as follows. (see paper)		
	a		Amber and Paul (Mum and Dad) can access all the files on the network. Megan, Blake and Jenny can only see their own files. Describe how the operating system allows these restrictions to be set up.	• Different groups/profiles • Different rights/permissions • Set up a public folder **1 mark for each bullet – maximum 2 marks.** *'Different users' is too vague for bullet 1. The concept of a group is required.* *'Access' is referenced in the stem and requires rights/permissions for a mark.*	
	b		Amber uses her tablet to take a photograph of the family. She then connects the tablet to the Living Room PC using an interface.		

Number			Question	Instructions	Marks
		i	State two tasks undertaken by an interface when transferring this photograph to the the Living Room PC.	• Data format conversion/ converting camera signals eg serial to parallel. • Buffering/temporary storage of data in transit between the camera and the computer/ compensates for differences in speed between the camera and the computer. • Handling of status signals/to ensure camera data is received correctly. • Voltage conversion/to change voltage levels of the camera to relevant levels for the computer. • Protocol conversion/ensure camera and computer adhere to the same protocols. **1 mark for each statement of 2 different functions - maximum 2 marks.** *Question is a 'state' and so underlined terms are acceptable.* *Note - Analogue to Digital conversion is not an appropriate example of data format conversion in this context.*	
		ii	Amber also transfers an uncompressed video from her tablet to the Living Room PC. Her video is 60 seconds long and was captured at 25 frames per second with a resolution of 704 x 480 pixels and with a bit-depth of 24. Calculate the file size of this video. State your answer in appropriate units.	704 x 480 = 337920 pixels per frame 24 x 337920 = 8110080 bits **(1 mark)** 25 * 60 * 8110080 = 12165120000 bits **(1 mark)** 12165120000 / 8 = 1520640000 bytes 1520640000 / 1024 = 1485000 kb 1485000 / 1024 = 1450.1953125 Mb 1.41620635986328 = 1.42 Gb Resolve units **(1 mark)**	**3**
	c		Amber is considering upgrading the Living Room PC. The current PC has a 32-bit processor with four cores. She is considering replacing this with a 64-bit processor with 4 cores. Explain why upgrading from a 32-bit to 64-bit processor will result in a improvement in performance.	• 64-bit cores will fetch and process 64 bits of data at a time. • This will halve the number of fetches needed by a 32-bit core. • Reducing the number of fetches will result in an improved smartphone performance. **Award 1 mark for implication of 64-bit cores.** **Award 1mark for reduction in number of fetches needed.**	**2**
	d		Amber creates an image using her tablet. This image is shown below. (see paper) Describe how this image would be stored as a vector graphic.	Image stored as two vectors **(1 mark)** Each with a number of attributes: x,y radius, fill colour. **(1 mark)**	**2**

Number			Question	Instructions	Marks
17			A function is used to test a password against a stored password value. (see paper)		
	a		Using this function involves the use of actual and formal parameters.		
		i	Explain what is meant by an actual parameter.	An actual parameter is a value passed to a function **(1 mark)** which occupies the space occupied by the formal parameter in the code **(1 mark)**	**2**
		ii	State a formal parameter from the function above.	• Password • storedPassword **Either for 1 mark**	**1**
	b		A hacker has created a program to break into a password protected system. The program reads data from a text file located at http://hackfiles.net/passwords.txt and stores the values in an array called passwords (see paper) Using pseudocode or a language of your choice complete the code to read from the text file and store the values in the array.	SET counter TO 0 DO RECEIVE data FROM (STRING) passwordData SET passwords[counter] TO data SET counter TO counter + 1 UNTIL <end of file> **1 mark for loop with until end of file** **1 mark for reading from file** **1 mark for array and array counter**	**3**

	c		Passwords should always be strong to ensure the security of digital systems. A strong password is typically at least 8 characters long and contains at least one number (e.g. 1,2,3,…etc) and one uppercase character (e.g. A, B, C, … etc).
			
			Using pseudocode or a programming language of your choice, write the algorithm which would check a passwords was strong and display a message stating whether or not the password is strong to the screen.
				SET numeric TO false
				SET uppercase TO false
				IF length(password) >=8 THEN
				SET length_valid = TRUE
				FOR EACH char in password
				IF (char=>"0" AND char <="9") THEN
				SET numeric TO true
				ELSE IF char=>"A" AND char<="Z" THEN
				SET uppercase TO true
				ENDIF
				END FOR
				END IF
				
				IF (length_valid AND numeric AND uppercase) THEN
				SEND "Password is strong" TO DISPLAY
				ELSE
				SEND "Password is not strong" TO DISPLAY
				END IF
				
				1 mark for checking string length
				1 mark for checking presence of number
				1 mark for checking presence of uppercase character
				1 mark for looping through each character(or similar)
				1 mark for displaying message to screen
					5

	d		Security is an important issue for businesses. To improve security businesses often consider migrating to a hybrid cloud.		

Number			Question	Instructions	Marks
		i	Describe what is meant by a hybrid cloud.	A hybrid cloud is a combination of a private and public cloud. **(1 mark)**	**1**
		ii	State **one** advantage for a business of switching to a hybrid cloud.	• Store sensitive data on the private cloud • Can outsource services to public cloud (at times of need) • Can easily expand capacity of public cloud storage without hardware costs • Public cloud use will not results in the purchase of new hardware/servers • Public cloud use reduces cost in relation to backup strategies. **1 mark for any 1 bullet**	**1**

Detail of Sources / Mark Allocations and Balance

Section 1	KU	PS	SDD	ISDD	CAS Area	Detail
1		1	1		Low-level operations and computer architecture	Use of binary to represent and store: integers and real numbers
2a		1		1	Structures and links (database)	relationships (one-to-one, one-to-many, many-to-many)
2b		1		1	Structures and links (database)	relationships (one-to-one, one-to-many, many-to-many)
3	2		2		Low-level operations and computer architecture	Computer architecture (trends and implications): cache
4		2	2		Algorithm specification	Analysis, exemplification and implementation of algorithms including: linear search
5	1			1	Structures and links (database)	primary keys, including compound keys
6	2		2		Low-level operations and computer architecture	emulators
7a		1		1	Coding	client-side scripting
7b		1		1	Coding	server-side scripting
8	2			2	Legal implications	Data Protection Act
9	2		2		Languages and environments	object-oriented
10		2		2	Testing	Beta testing, Usability, etc
11	1	1	1	1	Development methodologies	Agile methodologies
Total	**10**	**10**	**10**	**10**		

Section 2	KU	PS	SDD	ISDD	CAS Area	Detail
12a		1		1	Structures and links (database)	primary keys
12b		3		3	Design notations	entity relationship diagram
12c		3		3	Structures and links (database)	complex database operations (including queries)
12d		3		3	Structures and links (database)	complex database operations (including calculating)
13a	1			1	Structures and links (web-based)	cascading style sheets
13bi	2			2	Structures and links (web-based)	cascading style sheets
13bii		1		1	Structures and links (web-based)	cascading style sheets
13c		1		1	Structures and links (web-based)	page structure, including head,
13d		2		2	Structures and links (web-based)	page structure
13ei		1		1	Structures and links (web-based)	dynamic web pages
13eii	2			2	Coding	client-side scripting, server-side scripting

Section 2	KU	PS	SDD	ISDD	CAS Area	Detail
14a		2	2		Data types and structures	1-D arrays and records (including arrays of records)
14b		2	2		Data types and structures	1-D arrays and records (including arrays of records)
14c		2	2		Data types and structures	1-D arrays and records (including arrays of records)
14di		1	1		Testing and documenting solutions	logic errors
14dii	1		1		Testing and documenting solutions	logic errors
14diii		2	2		Algorithm specification	Analysis of other algorithms of similar complexity
14e		3	3		Testing and documenting solutions	trace tables
14f	2		2		Testing and documenting solutions	breakpoints
15a		2		2	Purpose, functionality, users	human users: expert, novice, age-range
15bi		2		2	Technical Implementation (hardware requirements)	input and output devices
15bii	1			1	Technical Implementation (hardware requirements)	input and output devices
15ci		2		2	Technical implementation (storage)	solid state
15cii		2		2	Technical implementation (networking/ connectivity)	Cloud systems and server provision
15d	2			2	Technical Implementation (software requirements)	proprietary v open source
16a	2			2	Technical Implementation (software requirements)	operating systems
16bi	2		2		Low-level operations and computer architecture	interfaces
16bii		3	3		Low-level operations and computer architecture	Use of binary to represent and store: video
16c	2		2		Low-level operations and computer architecture	Computer architecture (trends and implications): processor (registers, ALU, control unit)
16d		2	2		Low-level operations and computer architecture	graphics (bit-mapped and vector)
17ai	2		2		Computational constructs	parameter passing (value and reference, formal and actual)
17aii		1	1		Computational constructs	parameter passing (value and reference, formal and actual)
17b		3	3		Data types and structures	sequential files (open, create, read, write, close)
17c		5	5		Algorithm specification	Analysis of other algorithms of similar complexity
17di	1			1	Technical implementation	public, private, hybrid

Section 2	KU	PS	SDD	ISDD	CAS Area	Detail
					(networking/ connectivity)	
17dii		1		1	Technical implementation (networking/ connectivity)	public, private, hybrid

Mark distribution

CAS Areas	SDD	ISDD
Algorithm specification	9	
Coding		4
Computational constructs	3	
Data types and structures	9	
Design notations		3
Development methodologies	1	1
Languages and environments	2	
Legal implications		2
Low-level operations and computer architecture	14	
Purpose, functionality, users		2
Structures and links (database)		10
Structures and links (web-based)		8
Technical Implementation (hardware requirements)		3
Technical implementation (networking/ connectivity)		4
Technical Implementation (software requirements)		4
Technical implementation (storage)		2
Testing		2
Testing and documenting solutions	7	
Grand Total	**45**	**45**